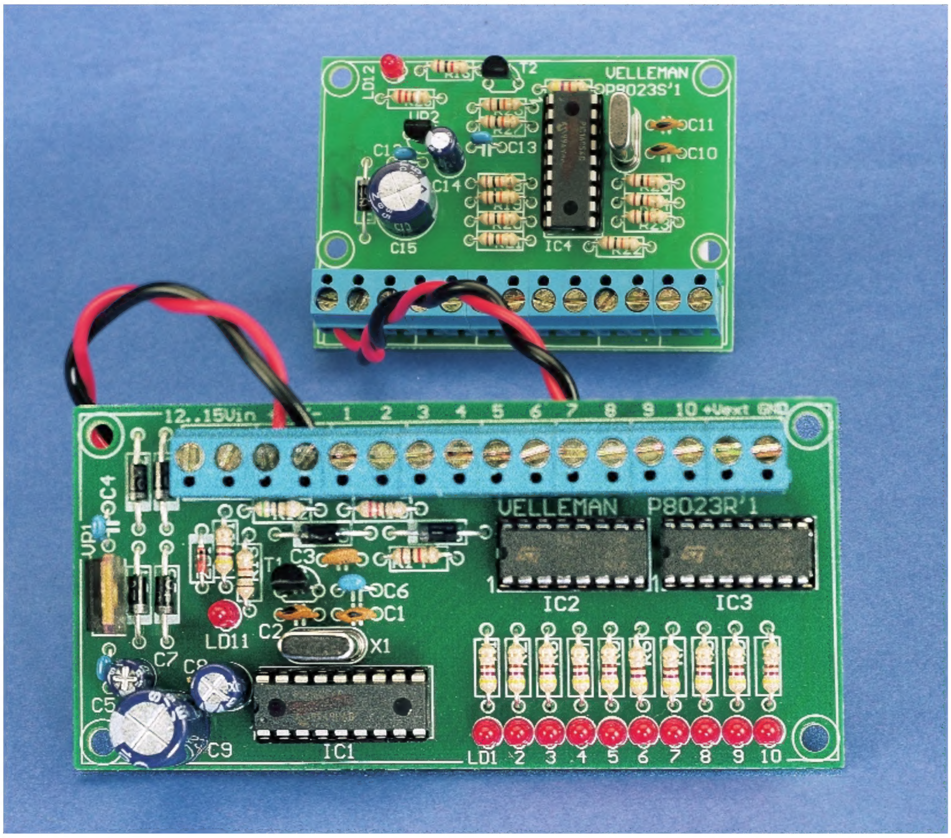
Two-Wire Remote Control

Switch ten channels via just two wires

By H. Steeman

This time we'll look at a kit for a remote control that allows you to send ten digital control signals over a distance of more than 50 metres. How? Using infrared? No, with just two wires!

When using a microcontroller or PC to control various pieces of equipment it is vital that the digital control signals can be sent reliably over larger distances, and in such a way that we do not need lots of cables. This circuit, which has been developed by Velleman, allows us to send ten digital signals through two wires. It can be used to cover distances up to 50 m.



Current loop

Figure 1 shows the circuit diagram of the transmitter. The circuit is built around a PIC16C54, a microprocessor used previously in *Elektor Electronics* projects. The ten inputs (1-10) are connected to the bus. All inputs have a pull-up resistor of 10 kΩ, which keeps them at +5 V when they are not connected. Seven inputs are connected to port B and three to port A of the processor. One output of port A drives transistor T2. The waveform used to drive T2 depends on the state of the logic levels found on the ten inputs. When T2 conducts, a current of about 50 mA (10 V/220 Ω plus the LED current) flows through the transistor. The receiver connected to the VTX lines (SK9) detects these current pulses. The use of a current loop is a good choice for this type of application because it is much less susceptible to interference than a voltage-driven signal.

The rest of the circuit is fairly straightforward. The voltage across the two control lines is 10 V. Diode D7 keeps capacitor C15 charged to this level in between the pulses. This is fed to voltage regulator VR2, which supplies the microprocessor of the transmitter (IC4) with a stable 5 V. Quartz crystal X2 and capacitors C10 and C11 provide a clock signal of 4 MHz.

Decoding

Figure 2 shows the circuit diagram of the receiver. A current detector is connected to SK2. The current pulses from the transmitter are converted to a voltage by R15, which drives the base of T1. Diodes D5 and D6 protect the transistor against any voltage surges that may be induced on the line. LED LD11 lights when a control signal is being received.

The received pulses are decoded by microprocessor IC1 (also a PIC16C54) into ten digital signals, again to ports A and B. Ten LEDs show the state of the digital outputs. The ten digital signals are fed to a ULN2003 driver IC. This chip contains power drivers with open collector outputs and internal protection diodes. These can switch relatively large voltages and currents (50 V/100 mA). The positive supplies of the switched loads have to be connected to +Vext.

The receiver supplies power to the whole system. The supply required is about 12 V AC, for example from a simple mains adapter (a DC adapter is also possible, as long as it supplies a minimum of 15 V). A bridge rectifier turns it into a DC voltage which is fed to VR1 (a 7810), which outputs a stabilised 10 V. This voltage is fed directly to the control cable. Resistor R12 and zener diode ZD1 provide a supply of 5 V to the microprocessor.

The type of cable chosen to make the connection depends mainly on where it will be used. Indoors we can use a simple (shielded) cable —outdoors it is better to use a more sturdy cable. We have tested the circuit over a distance of more than 100 m using telephone cable and found that it still worked reliably.

The complete kit comprising the transmitter and receiver is available under **order code K8023** from authorised Velleman dealers. For further information, see Vellemans' website at http://www.velleman.be
or email info@velleman.be

(005108-1)

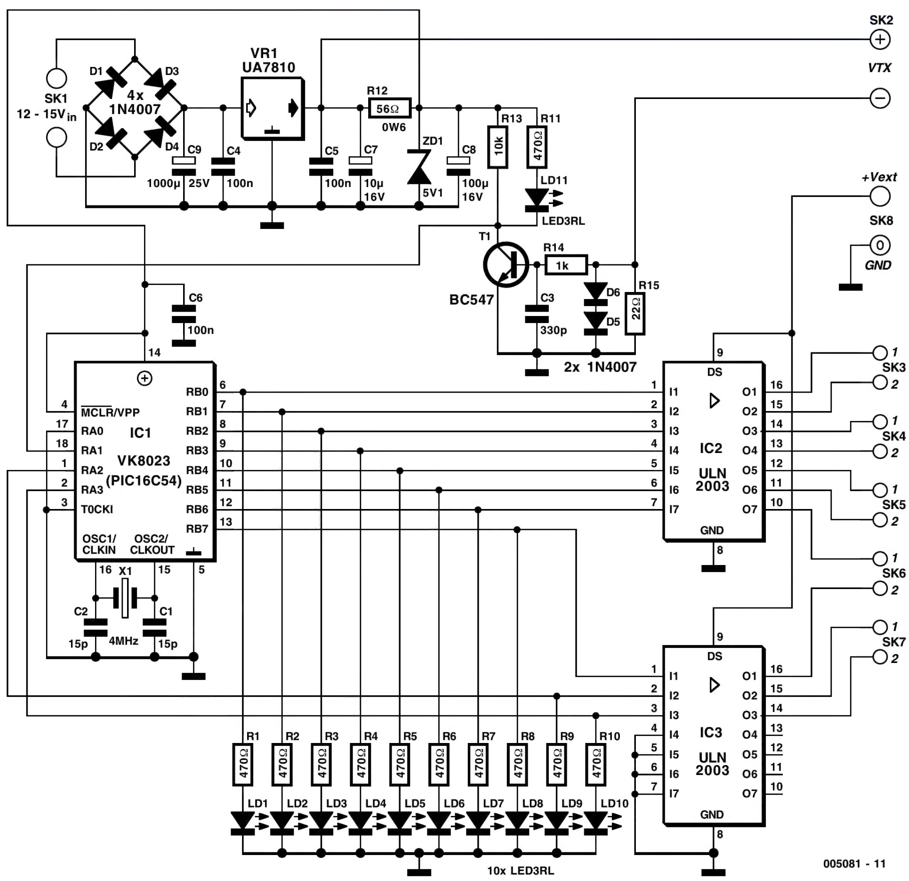


Figure 1. The circuit diagram of the transmitter. The use of PCB terminal blocks simplifies the connections.

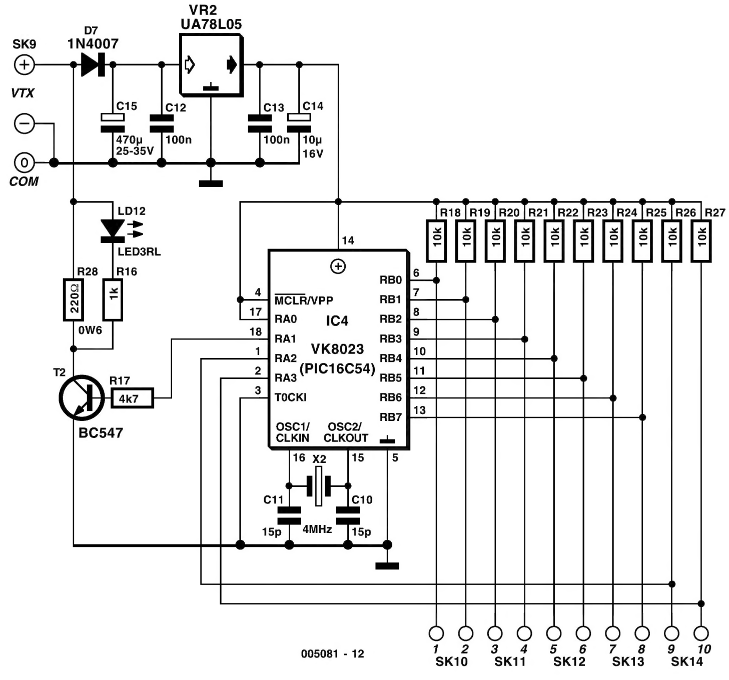


Figure 2. The receiver also uses a PIC processor to decode the current pulses.